OBSERVATIONS AND MODELING OF MICROSEISMS IN THE SANTA CLARA VALLEY, CALIFORNIA

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Introduction

Previous studies of the 3D velocity structure in the Santa Clara Valley (SCV) showed that teleseismic, local, and microseism data recorded by the 41-station Santa Clara Valley Seismic Experiment (SCVSE) are all sensitive to basin structure and that they may be used to refine the velocity model of the basins (*Dolenc et al.*, 2004; *Dolenc and Dreger*, 2004). In our recent work we focused on constraining the source of the microseisms and used this for modeling the microseism observations in the SCV.

Results

A recent study by Schulte-Pelkum et al. (2004) showed that seismic noise in Southern California is highly monodirectional and that the microseisms source can be localized. We have performed a similar analysis by using f-k array method for the data recorded during the SCVSE. Our results show that at low frequencies (0.1 to 0.3 Hz), wavefield observations in the SCV also display directionality (Figure 25.1). At higher frequencies (0.3 to 0.5 Hz), wavefield directionality is lost, which may be due to scattering of the waves by the 3D structure in the SCV basins. The important result of these observations is that the source can be localized and can therefore be used in numerical simulations. We used the 3D finite-difference code E3D (*Larsen and Schultz*, 1995) and the UCB velocity model (*Stidham*, 1999; *Stidham et al.*, 1999) to simulate the microseism wavefield. A vertically oriented CLVD source located about 27 km offshore was used to generate isotropic Rayleigh waves. We used the source time function that was a superposition of sine waves at discrete periods over the observed microseismic band. Results for the observed and simulated microseisms are presented in Figure 25.2; both display directionality and source localization for low frequencies.

Conclusions

The analysis of the observed microseisms in the SCV shows directionality and source localization for low frequencies which enables us to simulate the microseism wavefield. Analysis of simulated waveforms shows agreement with observations in terms of directionality at low frequencies. We plan to refine the method to simulate microseism wavefield by including the source spectrum derived from the ocean wave data recorded at the Santa Cruz buoy. Obtained results will further be used to develop a simultaneous inversion of the teleseismic, local, and microseism observations to constrain the velocity structure of the SCV basins.

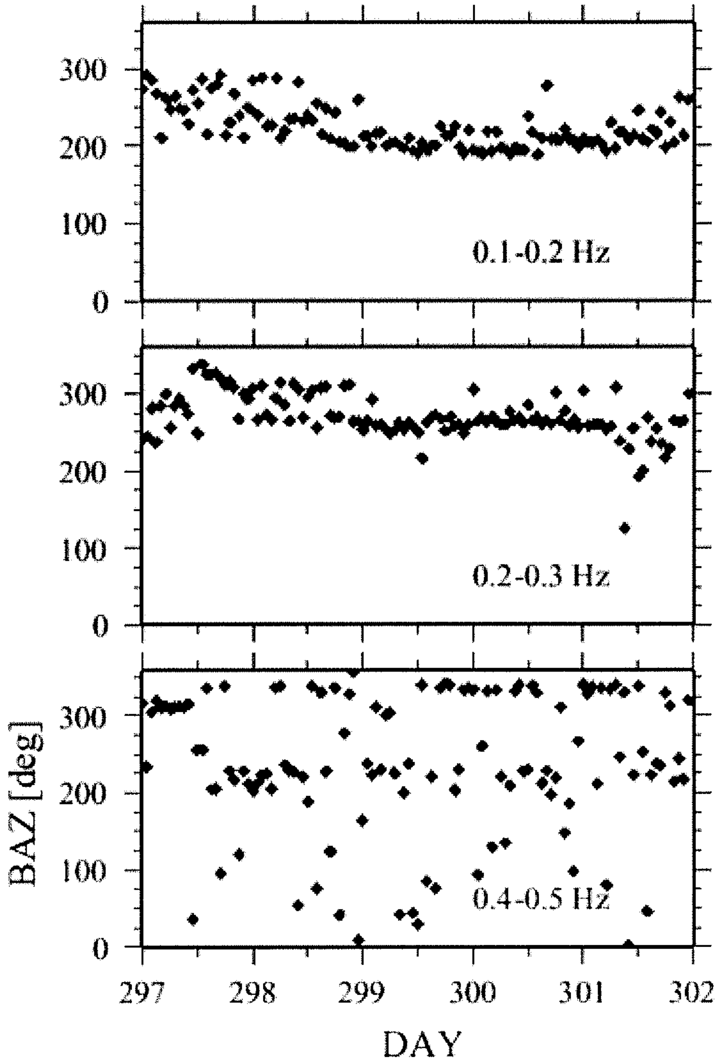

Figure 25.1: Backazimuth of the microseism wavefield over the 5-day period in 1998 determined with the f-k analysis. Results for the three frequency bands are presented.

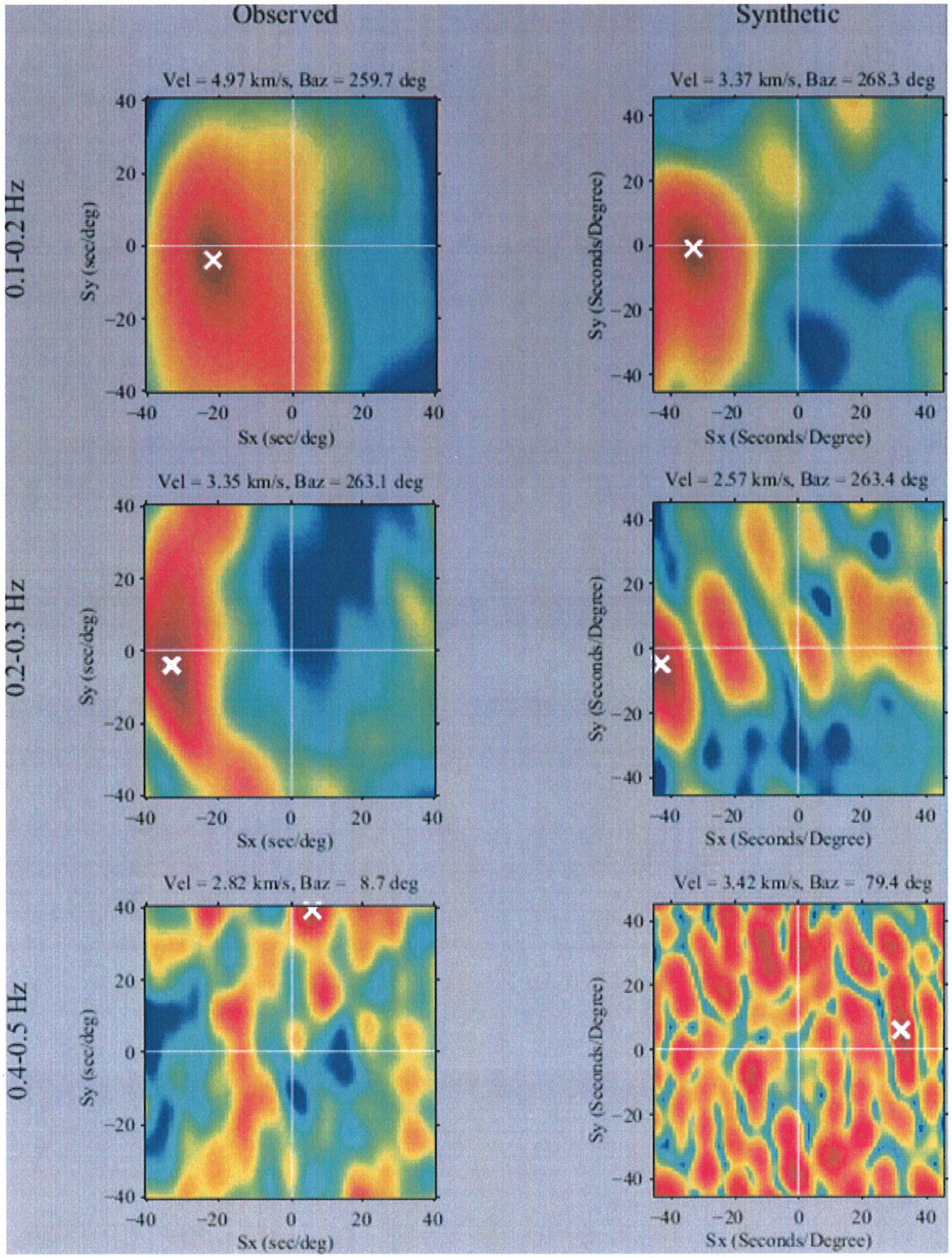

Figure: Observed (298.1998, 23 UTC) and simulated microseisms in the f-k slowness domain. Crosses indicate maximum power. In both cases, directionality and source localization is observed for low frequencies (0.1 to 0.3 Hz). A color version of this figure may be found on page .

Acknowledgements

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References

Dolenc, D., D. Dreger, and S. Larsen (2004). Basin structure influences on the propagation of teleseismic waves in the Santa Clara Valley, California, *Bull. Seism. Soc. Am.,* in revision.

Dolenc, D. and D. Dreger (2004). Microseisms observations in the Santa Clara Valley, California, *Bull. Seism. Soc. Am.,* in revision.

Larsen, S. and C.A. Schultz (1995). ELAS3D: 2D/3D elastic finite-difference wave propagation code, Technical Report No. UCRL-MA-121792, 19 pp.

Schulte-Pelkum, V., P.S. Earle, and F.L. Vernon (2004). Strong directivity of ocean-generated seismic noise, *Geochem. Geophys. Geosys., 5,* Q03004, doi:10.1029/2003GC000520, 13pp.

Stidham, C., M. Antolik, D. Dreger, S. Larsen, and B. Romanowicz (1999). Three-dimensional structure influences on the strong-motion wavefield of the 1989 Loma Prieta earthquake, *Bull. Seism. Soc. Am., 89,* 1184-1202.

Stidham, C. (1999). Three-dimensional crustal structure influences on wave propagation and generation of strong ground motion in the greater San Francisco Bay region, *Ph.D. Thesis,* University of California, Berkeley.

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